CLAIMS

I claim:

1. A high bandwidth efficient method for spread spectrum modulation using a chirp waveform, comprising the steps of:

(a) encoding an information data signal, the encoded signal having a plurality of symbols encoded at a symbol rate, each symbol having a symbol duration;

(b) splitting the information data signal into a plurality of parallel information data signals using a serial to parallel converter;

(c) generating a plurality of orthogonal chirp waveforms which are orthogonal in frequency;

(d) modulating said plurality of parallel information data signals with said plurality of orthogonal chirp waveforms in order to produce a plurality of parallel information data signals modulated on orthogonal chirp waveforms;

(e) combining said plurality of plurality of parallel information data signals modulated on orthogonal chirp waveforms to produce a combined waveform; and

(f) transmitting said combined waveform.

2. The high bandwidth efficient method according to claim 1, wherein step (d) further comprises modulating said plurality of parallel information data signals with said plurality of orthogonal chirp waveforms using binary phase shift keying.

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3. The high bandwidth efficient method according to claim 1, wherein step (d) further comprises modulating said plurality of parallel information data signals with said plurality of orthogonal chirp waveforms using quadrature phase shift keying.

4. The high bandwidth efficient method according to claim 1, wherein step (d) further comprises modulating said plurality of parallel information data signals with said plurality of orthogonal chirp waveforms using quadrature amplitude modulation.

5. The high bandwidth efficient method according to claim 4, wherein one of said plurality of orthogonal waveforms is modulated with frequency, time, and phase estimation data for synchronization.

6. The high bandwidth efficient method according to claim 1, further comprising the step of modulating said combined waveform with a radio frequency carrier before step (f).

7. The high bandwidth efficient method according to claim 1, further comprising the step of amplifying said combined waveform for transmission over wireline before step (f).

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8. The high bandwidth efficient method according to claim 1, further comprising the step of increasing symbol duration while keeping bandwidth constant, whereby system gain is increased while information rate is constant.

9. The high bandwidth efficient method according to claim 1, further comprising the step of reducing the symbol rate while keeping bandwidth constant, whereby system gain is increased while information rate is constant.

10. The high bandwidth efficient method according to claim 1, wherein step (c) further comprises generating a plurality of orthogonal waveforms which is fewer in number than the product of the bandwidth times the symbol duration, whereby power spectrum density is decreased without deterioration in bit error rate.

11. The high bandwidth efficient method according to claim 1, wherein step (c) further comprises generating a plurality of orthogonal waveforms equal in number to the spread spectrum processing gain, or the time-bandwidth product *BT*.

12. The high bandwidth efficient method according to claim 1, wherein each said orthogonal chirp waveform comprises a sequence of discrete values defining a chirp waveform, said plurality of sequences being orthogonal to each other.

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13. A high bandwidth efficient spread spectrum modulation system using a chirp waveform, comprising:

(a) at least one transmitter having:

(i) an encoder for encoding an information data signal;

(ii) an interleaver connected to said encoder for interleaving the information data signal;

(iii) a serial to parallel convertor connected to said interleaver for converting said information data signal into a plurality of parallel information data signals;

(iv) a plurality of stored orthogonal sequences, each sequence defining a chirp waveform;

(v) modulation means for modulating said plurality of orthogonal sequences with said plurality of parallel information data signals;

(vi) a combiner connected to said modulation means for combining said modulated parallel information data signals in order to define a combined signal; and

(vii) means for transmitting said combined signal; and

(b) at least one receiver having:

(i) means for receiving said combined signal;

(ii) at least one storage device having said plurality of orthogonal sequences stored therein;

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(iii) demodulation means for demodulating said combined signal using the plurality of orthogonal sequences stored in said storage device

(iv) a parallel to serial converter connected to said demodulation means;

(v) a deinterleaver connected to said parallel to serial converter for deinterleaving the demodulated serial signal; and

(vi) a decoder connected to said de-interleaver for decoding the received signal in order to reproduce the information data signal.

14. The high bandwidth efficient spread spectrum modulation system according to claim 13, wherein:

(a) said modulation means comprises a plurality of quadrature phase modulation circuits; and

(b) said demodulation means comprises a plurality of correlators.

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